carrier systems -- it takes four fiber systems, more than enough to serve a fraction of the 300 person town.

Pacific Bell had put into this area a 48 fiber cable. Why? Not to serve telephone service, but to set the stage for future broad band service.

There is is nothing wrong with that reality. Pacific Bell does want to set broad band services. That's fine. But you wouldn't take the cost of the that broad banned network and charge that to the basic telephone rate payer.

When our outside plant expert looked at that example, he said, "It is a terribly flawed example that they had used because of this phenomena that, basically, the network was tremendously overprovisioned."

It deploys fiber sooner leaving the central office then a telephone network used to. It has much bigger fiber cross section.

There is the reality. If you use the criteria of saying, let's look at the telephone company network that's there, and ask yourself is it the same as that network, it won't be.

It won't be for that reason and it won't be because also this is supposed to be a forward-looking model.

The FCC specifically said, "Do not consider imbedded costs." There are imbedded costs in that network today.

You can't look at the current cost of the telephone company either.

And I would fall back and say that what you have to then do is understand the engineering assumptions, read the documentation, test the model which has been done by several different telephone companies and -- let's be frank. They have not liked the results. They have suggested inputs -- which we'll get to later -- that they claim would be more appropriate.

You can test it like that. That's the way I believe you test it. I don't think you compare it to GTE's network today. I don't believe there is a reality.

I don't think you can get away from these problems I talked about. So that's my answer to reality.

You then have to look at the expertise of people who did it, if you could examine the GTE complex models and then look at the assumptions they make.

ALJ WEISSMAN: Let's move on to the next area.

WITNESS MERCER: I thought this came later. The next one I have is input prices versus output.

I understand the theory that was in the attachment to this testimony said, "If you vary prices 10 percent, the results should go up 10 percent."

That should be from an economic point of view. I don't quibble with that. I know that's going

to cause the following problem.

If you don't set the inputs carefully, you have the following situation -- when we do our capital carrying cost calculation, you, for instance, gross up the amount each year of investment being recovered from the equity.

You gross that up by the inverse of one minus the tax rate in order to make the equity rate return after tax.

You have got a non-linear equation because you have got an amount of investment in the enumerator which would go up 10 percent, if you change the investment 10 percent, which has divided by one minus the income tax rate.

When we hear this comparison, which we can't really examine, was the income tax rate also increased 10 percent?

It should have been. The calculation we did is the right way. Economists say that's the right way to do capital carrying calculations.

I know very well that result is not going to be a linear result. I'm not an economist. I'm a mathematician. And as a mathematician, if you take that non-linear term, you won't get a linear result.

I would need to understand a great deal more about what was varied because we have not done a similar calculation what was varied.

I do know in a recent analysis I saw, if you

just varied the technology costs by 10 percent, indeed you get very close to a 10 percent effect, you wouldn't get exactly 10 percent because there are a few components in the model that are not related to investment.

There is, for instance, a carrier to carrier cost. How was that treated in this analysis? I don't know.

I find it very difficult to say, "Let me do the nice little two plus two equals five example."

This is a complex business. And while I don't quibble with an economist's theory that says those should relate directly, I would need to understand in much more detail what prices should be varied and what are the limitations in that equation.

I don't find that a personally particularly useful exercise.

ALJ WEISSMAN: Do you agree, Dr. Duncan, you're not also talking about a linear?

WITNESS DUNCAN: Yes and one of the amazing things about cost analysis -- that's why this is very important.

All cost functions, whether they are linear or non-linear, have a certain mathematical structure. It's called first-degree homogeneity in prices.

That means, if you double all of the prices together, the cost no matter how non-linear the relationship, the costs will exactly double.

If you increase all of the input prices 10 percent, the costs should go up exactly 10 percent.

It is a function of the minimization that goes on.

Now this stuff appears in textbooks and you can go and see any cost function that represents minimum costs of producing something suggest some input prices.

This is first-degree homogeneity in prices. That means, if you increase the prices 10 percent, the costs will go up 10 percent.

If we miss something, if we increase part of the prices 10 percent -- not all of them -- then the costs shouldn't have gone up by as much as 10 percent. They should have gone up eight percent or six percent.

Our problem is: You raise the prices 10 percent and the costs went up 13 percent. If we missed something and didn't raise that, the costs would have gone up even more.

I'm saying there is an inconsistency here.

I understand that it is difficult to test the model, but I'm here to tell you whether the model is valid or not or to give you advise about the extent to which you can believe it or not.

It hasn't been compared against reality.

ALJ WEISSMAN: I want to stop you here.

Off the record.

(Discussion off the record)

On the demand side -- I can talk a little bit.

In the sense that the demands you are going to expect will, in fact, be quite non-linear particularly as competition comes in.

Even without competition, we find that the growth, the change in demand, et cetera, is not linear. It's not simple in any sense. As competition comes in, that's going to be even worse.

I'm not simply talking about how demand grows. Even if demand grew linear, unless the cost function itself really is linear, you should not expect to get the right answer by putting in the average demand over a period of time, as opposed to evaluating the costs at every period of time and adding them together.

MR. LAKRITZ: You're aware if GTE has done that?

WITNESS DUNCAN: I'm not aware whether GTE has done that at all.

ALJ WEISSMAN: Thank you. Shall we move on?

WITNESS MERCER: The next I have is competition.

There is at least two aspects of that and one of them has to do with this discussion of fills and cable.

The complaint is that we haven't taken into account the potential competition.

The first thing I might note is that I haven't heard any person in any proceeding point out

that we're being on the one hand assailed for not providing for growth for second lines ala the previous discussion. And on the other hand, we're being assailed for not providing for shrinkage.

A tongue and cheek comment would say the average of the growth and shrinkage I'm hearing about averages out to zero.

That's not intended to be a serious comment.

What does competition do? This is an unbundled network element proceeding. Unbundled network elements sold to AT&T or MCI or any other party do not decrease the demand for loops or switching. They are just being sold in a different form.

This proceeding is not signaling the onset of competition.

Secondly, there's a lot being said about loss of market share.

I need to point out that loss of market share is not the same as loss of demand.

AT&T went from owning 90 plus percent of the long distance market to owning 60 percent of it over a period of 12 years.

In that time, their growth has grown -- their demand has increased substantially. The total growth has still been there because the entire market has been stimulated and/or was growing naturally.

If I were to take competition into account -- For starters, I would increase the fill factors because

I no longer have to have a growth component represented by those fill factors.

And secondly, I would then begin to say, "Beyond that point, how much shrinkage and demand is there and over what time frame? And isn't it the case that the telephone company will have enough time to react by, for instance, putting in less growth, higher fill factors and the like."

We looked at that issue and we ended up saying, "There is no way that we can adequately represent the future competition."

Ergo, we will not treat it because the magnitude and size and effect on things like fill and cable size and the like is simply not known at this point.

ALJ WEISSMAN: Reaction?

WITNESS DUNCAN: Nonetheless --

ALJ WEISSMAN: I don't want "nonetheless." I want a reaction.

WITNESS DUNCAN: The competition has a number of effects.

One of the effects in my belief will be to change the mix of things that are demanded.

To the extent that there are cost complimentaries and the model can't handle those, the change in the mix -- the cost changes that come from the change in the mix are totally missed.

ALJ WEISSMAN: Can we reliably predict the change

in the mix right now?

WITNESS DUNCAN: I think so.

I think there is a fair amount of market research out there that every firm has done that gives them a fairly good idea of how things are going to change and which way these things are going to change.

ALJ WEISSMAN: Give me an example of one that people can predict.

WITNESS DUNCAN: I could be wrong about this.

I believe that it was AT&T's Chairman that said that they would have 30 percent of the local market in one year.

I assume he based that on market research.

Those are the kinds of statements I'm talking about where people have done some market research and they have a pretty good idea how the market shares are going to change.

The question is: Do the changes in market shares effect the demands?

MR. LAKRITZ: Are you familiar with market research? In more particularity, the projections that were put forward in the Commission's IRD or interlata toll proceedings and what has happened to the market subsequent to being opened to competition?

WITNESS DUNCAN: Yes.

MR. LAKRITZ: Would you agree that many of the predictions that many of the people made did not come true on both sides by competitors and by incumbents?

WITNESS DUNCAN: On the IRD, with respect to certain models? The answer is yes.

On the other hand, with respect to the predictions about the extent of competitive losses. Those were based on market research.

Whereas, some of the others were time series models that were not based on market research, I would say those models were pretty close.

MR. LAKRITZ: At this point in time, no one has examined Chairman Allen's statement to see whether it was based upon time series.

The point I'm trying to make is that people's predictions about telecommunications didn't seem to be a very terribly accurate business. I put it up there with weather predictions.

WITNESS MERCER: We refer to it in our company as competition by headlines.

MR. LAKRITZ: I'm interested in hearing Dr. Duncan's different view point.

WITNESS DUNCAN: I guess my view on that is that to the extent that there is uncertainty in those market forecasts, that those are simply added to the other uncertainties associated with a model moving into competition, all of those things should get blended into the cost of capital and to the risk involved.

While the forecast may not be on the spot, and people were aware of that, you don't use them as point estimates and say, "This will happen." What you

say, "There is going to be a range here" and you plan accordingly.

That shows up in the kinds of costs of capital you face, costs of money you face.

ALJ WEISSMAN: Let's get back to the models. That's an interesting point about regulation.

You're saying that -- you're suggesting that the Hatfield Model is less reliable because it doesn't attempt to differentially predict the impacts of competition.

WITNESS DUNCAN: That's correct.

ALJ WEISSMAN: So responding by saying, "That's right. People's predictions are necessarily going to be accurate. That's why you have changes in cost of capital or rate of return."

That doesn't tell me why the Hatfield Model's wrong, if it doesn't differentiate based on competition.

WITNESS DUNCAN: Because it assumes, in my opinion, a too low rate of cost of money.

It doesn't take into account that on a going forward basis that people who used to be willing to accept 11 percent with near certainty might now demand 30 percent -- understanding that next year it might not be there because of the competition.

The rate of return that has to be offered to get funds to invest goes up because of the competition.

The costs of capital goes up. That's what I

was responding to.

ALJ WEISSMAN: We move to another issue. You think the rate of return isn't high enough.

WITNESS DUNCAN: It was the effects of competition.

WITNESS MERCER: I had that as a separate issue. I don't know if you want to do that now.

ALJ WEISSMAN: Sure.

WITNESS MERCER: Let me just correct the record.

Chairman Allen said that in five years, AT&T would achieve 30 percent penetration, not one year. But that was also noting specifically a substantial component of resale.

He didn't specifically say -- he said resale and resale like unbundled elements don't take demand away from the telephone company.

It was a statement for the financial community. I don't believe it was a market research statement. It was really 30 percent and five years.

Now the cost of capital is an interesting one.

You would adjust cost of capital. You might adjust depreciation rates. I've had trouble with depreciation rates because it doesn't seem like competition accelerates the aging of equipment.

Economists say it does.

You do have to do something there. The problem, again, would be what would you do today?

The FCC, in its order, looked at its 11 and a quarter percent interstate return and said they were opening an inquiry to see specifically, not if it should change, but if it should lower because their judgment was that it might be too high. The trust was clearly to look lowering it.

We used 10 percent cost of capital. They are at 11 and a quarter. They are looking at coming down.

There is an analysis under way at AT&T as to what that correct rate should be.

I don't believe that analysis is completed yet. I do know quite clearly that economists have not yet at all agreed on how much, if any, the costs of capital should go up and would you do it today or do it even near term with the current embryonic state of competition.

I don't disagree in principle that that may be an effect of competition. I would say, again, from paramatizing the model that we had no better number to use than the default which AT&T believed was already a generous 10 percent and see where it goes from there.

It is like many things, a user input. It was so thought that that number was too low or the depreciation rate's too low, you could change those, but that doesn't represent a defect in the model. It represents a lack of certainty about what you would do today.

ALJ WEISSMAN: Did you have any items that you

recalled under the input category?

WITNESS MERCER: Not under the input category, no.

ALJ WEISSMAN: Off the record.

(Discussion off the record)

ALJ WEISSMAN: On the record. We'll be in recess for 10 minutes.

(Recess taken)

ALJ WEISSMAN: On the record.

Dr. Mercer, I was interested in your reactions to Dr. Duncan's comment about the absence of documentation or definition for inputs.

WITNESS MERCER: I guess I thought we had done a very good job of documentation in at least the paper version.

The documentation in this testimony is about 40 plus pages. We used BCM and don't have all the detail of BCM. That's a long documentation.

The inputs almost universally -- I can't say in every single one of them -- but the inputs are things like cost per foot of certain size cable, fill factor by density zone, separately for distribution cable, feeder cable, the cost of signalling transfer point and signalling System 7 network.

I'm drawing a blank -- the cost of serving area interfaces.

We thought that the parameters: A, were mostly self-explanatory. And B, the documentation

described in enough detail what we were doing to make the model usable.

I can only tell you there are telephone companies running the model. I testified in New Jersey last week and the Bell Atlantic people -- they took six areas of the model which probably involves 50 or so of the inputs and run sensitivity studies by changing those inputs.

I'm not sure you would ever get thorough documentation so good that nobody would complain about it, but I think it's pretty good.

It's a qualitative judgment. It's obviously self-serving, but I thought we did quite a bit to make it obvious.

Through the inputs, we have made the model quite variable and allowed the users to do a lot of different studies.

ALJ WEISSMAN: These are very broad assessments of whether there is an adequacy of documentation.

How can you, Dr. Duncan, help me put some boundaries on this?

WITNESS DUNCAN: The first thing is that there are two kinds of documentation that you expect with computer programs; one is the manual -- and I'll talk about that later. And the other, is the documentation of the code.

In the documentation of the code, usually each line of code or each module of code, there is a

set of comments saying, "This set of code was written by so and so, modified by so and so. It is intended to do this. It uses inputs from this part. It uses inputs from that part."

You don't have that sort of thing in the Hatfield Model. It's not documented in that sense.

It's not documented in another sense.

For example, it seems clear when you hear it when somebody says -- let's take one in here -- conduit installation per foot.

That seems like it should be self-explanatory.

I don't know from any documentation in here what is included in that. Is that wages? Is that wages and benefits? How are the benefits loaded on that? Are they loaded on? Are they excluded?

Is this based on wages paid to individuals, by individual firms, or is this wages by looking at what people who do this kind of work get in this particular region?

If so, where is the back up for this? Where is the documentation that tells me what this is. If I were to go out and do conduit installation per foot, exactly what things would I be putting in there?

The second question would be: What justifies or what is the back up for the default values and the input values that the Hatfield people used? On many of these things, I simply don't know.

There aren't the definitions to tell me exactly what goes into that.

I'm not saying that anybody's being lividus here. I'm simply saying, "You can not tell by looking at the input sheets nor reading through the documentation."

You can't go through a glossary and have it say this means such and such and if you wanted to do this yourself, the way we did it, you would put these things together from these kinds of counts.

It's very, very difficult to use.

The second thing is: Although there are lots of pages of documentation, we spent an awful lot of time trying to get the model to run and I have good people trying to get this model to run.

The documentation was almost useless in trying to do that.

On some things, I will admit that we had access to other people who said, "Oh, yes. We were able to get it to run this way, but we weren't able to do this. What did your guys do? Our guys got it to run this way."

The way this model ran wasn't by people taking the manual going, "Ah, ah." It was a bunch of people who are used to playing around with Excel spread sheets and trying things and comparing notes.

My understanding is very few people have tried to run this have gotten it to run.

I don't know whether you want to view that as a documentation problem. I do view that as a documentation problem.

You can't pick up the manual, slip the disk or CD ROM in and run the thing. The manual is not a useful manual in my opinion.

Now the equations that are in there are not documented at all.

One has absolutely no idea what an equation in a particular cell is supposed to do. If you open the thing up, what is that equation supposed to do. You don't know. You can't trace it because it's password protected. You can't say, "I want to see how this input gets used."

For example, depreciation life on something. I would like to know how this is used throughout the program.

One way of doing that is to turn on the auditing procedure, find all the places that this is used and it will show you and you can trace it through and see if that does make sense.

You can't do that. The auditing procedure is turned off by the authors and password protected.

As a consequence, what you have to do is go through by hand to every one of those cells and say, "Okay. Find every instance of this cell."

I don't know if you know how Excel ranges are discussed.

A range might be H-1 through H-50. If I wanted to know where H-45 was used and they had a range equation, I could never find that going through searching for H-45. I would need the auditing procedure do that.

It's those kinds of things. The lack of documentation, both internally and externally, caused a lot of problems and caused a lot of problems in just understanding what the model was supposed to do.

Not having clear definitions or assuming that the reader's going to come in and see this and understand expense in the same sense that they understand it without a definition.

ALJ WEISSMAN: Quickly. Are there equations that are not explained?

WITNESS MERCER: There are equations that are not explained. We did not explain every single equation.

We assume somebody that wanted to analyze the model at that level of detail would be enough engineering-oriented to be able to do it.

We did not think that was our obligation. We thought that by making the model readable, there was an option, of course, of locking the spread sheet so you couldn't even read the formulas.

We did not do -- I might be wrong in saying this -- you could not unlock the audit function without unlocking the model period.

If you unlock the model period, our view is

APPENDIX F

Decision REVISED PROPOSED DECISION OF ALJ WONG (Mailed 10/9/96)

BEFORE THE PUBLIC UTILITIES COMMISSION OF THE STATE OF CALIFORNIA

Rulemaking on the Commission's Own Motion into Universal Service and to Comply with the Mandates of Assembly Bill 3643.	R.95-01-020 (Filed January 24, 1995)
Investigation on the Commission's Own Motion into Universal Service and to Comply with the Mandates of Assembly Bill 3643.	I.95-01-021 (Filed January 24, 1995)

(See Appendix F for List of Appearances.)

deficiency with the BCM, and at the time hearings concluded, were modifying the model to correlate the population with the road pattern in these less dense areas. The CPM's grid cell design avoids this problem by identifying the location of population in a more precise manner.

The BCM assumes that structure costs vary in direct proportion to the costs of those facilities. This means that a discount on material costs, for example, copper cable, will lead to a corresponding drop in the supporting structure costs, such as trenching costs. This also means that the model incorrectly assumes that the costs of placing facilities will vary with the size of cable. For example, the BCM assumes that a cable one quarter the size of the standard cable, will cost roughly one quarter as much as the standard cable, and will require a trench one quarter as deep. The joint sponsors of the BCM have recognized this problem as well, and are working to correct it.

The HPM attempts to rectify this problem by incorporating the installation factor for facilities in these two lowest population density zones. This installation factor adjustment represents somewhat of an ad hoc solution. It fails to address this deficiency in the more densely populated areas. The CPM avoids this problem by separately identifying costs for facilities placement from their cable costs, and separating per foot and per pair cable costs.

The BCM's process of taking irregularly shaped CBGs, assuming that they are square, and placing feeder and distribution plant accordingly, also raises a number of concerns. In rural areas where CBGs can be quite large, the BCM assumes that copper distribution plant can serve the entire interior. It is unclear whether the BCM allows for sufficient electronics in the distribution plant to ensure that these households could actually receive telephone service from the network as modelled. This deficiency has been recognized by the developers of the BCM.